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(54) Title: COMMUNICATION APPARATUS OPERATIVE TO SWITCH DYNAMICALLY BETWEEN DIFFERENT COMMUNICATION CONFIGURATIONS
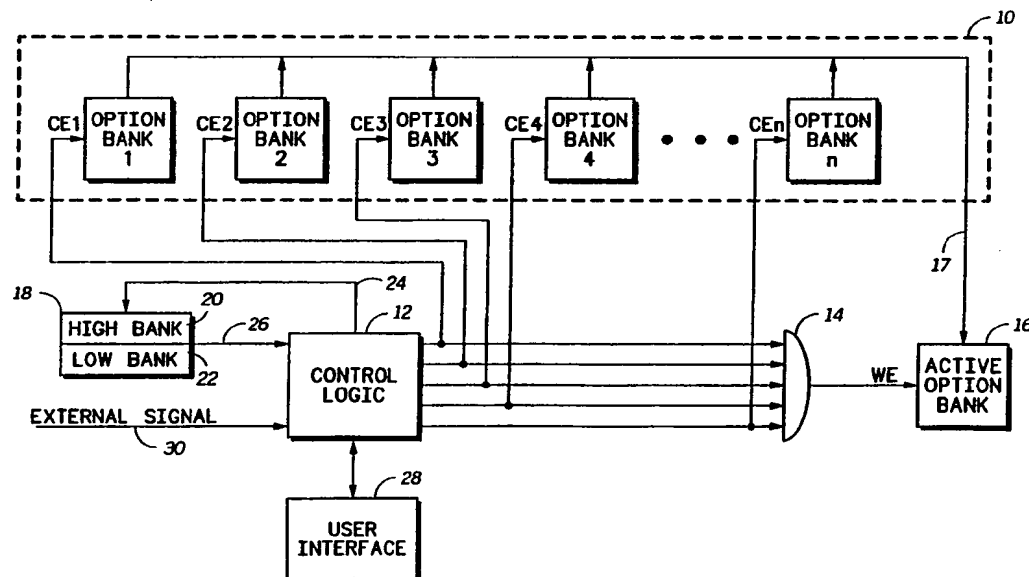
(57) Abstract

Communication apparatus is operative to switch communication dynamically between itself and a selected one of a predetermined plurality of mating communication devices of different configurations. A memory (10) is provided for storing a plurality of different sets of configurables with each set of the plurality corresponding to a communication configuration associated with a corresponding mating communication device of the predetermined plurality, each set of configurables being indexed in the storing means by a unique memory address. A controller (12) is also provided and is responsive to a command signal to select an index memory address for use by the communication apparatus to functionally configure itself in accordance with the set of configurables of the memory storage corresponding to the index memory address selected by the command signal.

Communication Apparatus Operative to Switch Dynamically Between Different Communication Configurations

Background of the Invention

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The present invention relates to communication apparatus in general, and more particularly to communication apparatus operative to switch dynamically communication

10   between itself and any one of a plurality of mating communication devices of differing communication configurations.

Today, data terminal equipment (DTE), such as main frame computers, personal computers and the like, may

15   communicate digital information amongst each other over some communication medium. Each data terminal employs data communication equipment (DCE), such as a modem, for example, to convert the digital information from the DTE into appropriate signals for transmission over the communication

20   medium to a mating DCE and similarly to reconvert the received signals from the mating DCE back into corresponding digital information for the receiving data terminal. Modern communication equipment has become very sophisticated with the utilization of micro-computer systems which permit the

25   equipment to be configured with a wide variety of optional features which are known as "configurables" and sometimes referred to as "straps". An example of a set of configurables is shown in Table 1 infra.

In modern modems, such as those manufactured by Codex

30   bearing Model Nos. 2266, 2660 and 2264, for example, a prespecified portion of memory known as the active configuration memory stores binary codes representing the chosen option of each configurable. Each configurable of a given set is assigned a bit or plurality of bits of memory

35   storage in the active configuration memory. And, the binary

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coding of the assigned bits represent the desired option of the configurable or strap. For example, referring to Table 1, the modulation mode may have 8

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different options and therefore requires at least three bits of
assignable memory storage. The assignable bits then may be
coded according to the option desired. If auto V.32 is chosen
as the desired option, the bits may be coded "001", for example.
5   Note that for the configurables of low speed format, adaptive
rate selection, long space disconnect, and so on have only two
options and therefore require only one bit of assignable
memory storage. Accordingly, the binary coding, that is "0" or
"1", determines the selected option for each of these
10   configurables. It is understood that the options of the set of
configurables for the communication device are chosen so that
it may be compatible in its communication configuration with
the communication device it desires to mate with. Generally, a
modem stores only one set of configurables in its active
15   configuration memory which it uses to configure itself for
compatible communication with a predetermined mating
communication device.

         At least one known modem accommodates the storage of
different sets of configurables, but has only one active
20   configuration memory for use in configuring itself. This
modem is progammed to permit a manual strap change, that is,
to allow the loading of another set of configurables from the
stored sets of configurables into the active configuration
memory by manually entering commands through a front panel.
25   The drawback to this, of course, is that it cannot be
accomplished dynamically, that is, automatically in response
to some demand situation without user intervention and
without the interruption of communication. User intervention
for this purpose is not always convenient, because the modem
30   may not be at the same location as the user requiring the user
to go to the location of the modem which may be in another
building, in some cases, to initiate manually the change in sets
of configuration to permit the modem to configure itself to be
compatible with another mating communication device.

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The interruption of communication is especially a critical factor where a remote office, like a bank, for example, is communicating large volumes of information to a central office over a high speed leased line medium and the leased line
5   fails for one reason or another. Modern modems have the capability of restoring communication through a backup dial line network automatically. This process is commonly referred to in the industry as "restoral". However, because the modem is restricted to only one set of configurables stored in
10   its active configuration memory it may have to reestablish communication with the same mating communication device to retain compatibility in the communication configuration.

It is desired for some critical situations, especially for the restoral situation, that the transmitting modem be capable
15   of switching communication dynamically to another mating communication device of a different configuration. During restoral, for example, this feature permits the modem to auto dial a predetermined modem of a central service center, for example, to apprise the center of a failure of the leased line.
20   In addition, in a packet switching network, when the primary node is identified as malfunctioning, the modem may restore communication through a secondary or alternate node automatically without loss of communication and without human intervention. The present invention renders a
25   communication device which overcomes the aforementioned drawbacks of present modems and provides for the above stated dynamic switching feature.

Summary of the Invention

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In accordance with the present invention, communication apparatus is operative to switch communication dynamically between itself and a selected one of a predetermined plurality of mating communication devices of differing configurations.
35   The communication apparatus comprises a storing means and a

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control means. The storing means stores a plurality of different sets of

configurables with each set of configurables of the plurality corresponding to a communication configuration associated with a corresponding mating communication device. Each set of configurables is indexed in the storing means by a unique

5   memory address. The control means is responsive to a command signal to select an index memory address for use by the apparatus to functionally configure itself in accordance with the set of configurables of the storing means corresponding to the index memory address selected by the

10   command signal.

In one embodiment, the control means responds to the command to dynamically control the apparatus to switch from using the set of configurables of the memory means associated with a first mating communication device to use the set of

15   configurables of the memory means associated with a second mating communication device for establishing the communication configuration thereof.

In yet another embodiment, the communication apparatus is operative to switch communication dynamically between

20   itself and any one of at least two mating communication devices selected from a predetermined multiplicity of mating communication devices of different configurations. In connection with this embodiment, a second storing means is used to store the index memory addresses of the sets of

25   configurables corresponding to the selected at least two mating communication devices. An entry device may be used for entering the index memory addresses of the selected sets of configurables into the second storing means. The control means responds to the command signal to access an index

30   memory address from the second storing means and to load a third storing means with the set of configurables from the first storing means corresponding to the accessed index memory address The apparatus may then functionally configures itself in accordance with the set of configurables

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loaded into the third storing means as selected by the command signal.

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Brief Description of the Drawings

Fig. 1 is a functional block diagram schematic of communication apparatus which is suitable for embodying the 5   principles of the present invention.

Fig. 2 is an exemplary software flowchart for use by the embodiment of Fig. 1 in performing one aspect of the present invention.

Figs. 3A and 3B depict an exemplary software flowchart 10   for use by the embodiment of Fig. 1 in performing another aspect of the present invention.

Fig. 4 is an illustration exemplifying dynamically switched communication on demand between a communication device and a selected one of either of two other mating 15   communication devices in accordance with one aspect of the present invention.

Description of the Preferred Embodiment

20   A functional block diagram of apparatus of a communication device, such as a modem, for example, which apparatus may be used for embodying the principles of the present invention, is shown in Fig. 1. A typical modem suitable for accommodating the embodiment of Fig. 1 may be of the type 25   manufactured by Codex bearing Model Nos. 2266, 2660 or 2264, for example, all of which have been marketed by Codex more than one year prior to the filing date of the instant application. The construction and operation of these type modems in configuring itself using the set of configurables stored in the 30   active configuration memory thereof is well known to all those skilled in the pertinent art. Accordingly, the details of how a modem configures itself using the set of configurables of the active configuration memory will not be described herein for this reason.

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Referring to Fig. 1, a conventional storage memory 10,
which may be of the non-volatile type for the present

embodiment, stores a plurality 1-n of different sets of
configurables with each set of configurables of the plurality
corresponding to a communication configuration compatible
with a corresponding mating communication device. In the
5   present embodiment, the storage memory 10 includes a
plurality of memory storage banks, denoted as 1-n, for storing
correspondingly each of the plurality of different sets of
configurables. As mentioned above, a typical set of
configurables and the possible options of each is shown in
10 Table 1 infra. Control logic apparatus 12 which may be a
conventional microcomputer system, for example, is coupled to
the memory 10 through a set of control and address lines
denoted as OE1 - OEn. The lines OE1 - OEn are coupled
respectively to the memory storage banks 1-n. Further, the
15 signal lines OE1 - OEn are coupled to respective inputs of an OR
gate 14 which generates a write enable signal (WE).

        Further included in the embodiment of Fig. 1 is an active
configuration memory 16 which is loadable with a set of
configurables accessed from a selected memory bank utilizing
20 a data bus 17 and write enable signal (WE). The set of
configurables of the memory 16 is used by the modem in
configuring itself in a communication configuration compatible
with the desired mating communication device. This operation
is well known to all those skilled in the pertinent art and
25 requires no further description here. Still further included in
the embodiment of Fig. 1 is another memory 18 coupled to the
control logic 12. For the purposes of the present embodiment,
the memory 18 includes two registers 20 and 22 for a storage
of address information. The control logic 12 may select one of
30 the registers 20 or 22 from the memory 18 using the control
and address lines 24 and the contents of the selected register
20 or 22 is provided to the control logic 12 although signal
lines 26. A user interface 28 may also be provided and coupled
to the control logic 12. In the present embodiment, the user
35 interface may be a conventional modem

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front panel with pushbuttons for entering information via the control logic 12 into the memory 18. Finally, a command signal is coupled to the control logic 12 over a signal line 30.

5   Further in the present embodiment, each of the memory banks 1-n may be indexed by a unique memory address for accessing the set of configurable stored therein and loading them into the active configuration memory 16 via data bus 17. At least two sets of configurables may be chosen by an operator through the front panel 28 by entering the index
10 memory addresses of their corresponding memory banks into the registers 20 and 22 of memory 18 via control logic 12. An exemplary software flowchart for use by the control logic 12 for performing this function is depicted in Fig. 2. Referring to Fig. 2, in the decisional block 40 the control logic 12 first
15 determines if a particular key or pushbutton has been stroked via the front panel 28. The decisional block 40 sits in a loop 41 until the particular pushbutton or key has been stroked, at which time execution continues at the decisional block 42. In block 42, it is determined whether or not the control logic has
20 been selected to respond to the command signal 30. If not, the execution is returned to the block 40 and nothing happens. However, if the command option has been selected the execution continues at block 44. In block 44, the control logic 12 awaits a keyed in number from a keypad, for example,
25 through the front panel 28. If no number is entered after a time out period the execution is returned to decisional block 40. Should the number be entered within the allowed time interval, the instructions of the particular case option 1-12 corresponding to the entered number are carried out and then,
30 execution returns to block 40.

In the example of Fig. 2, twelve case option instructional blocks have been preprogrammed utilizing four memory storage banks 1-4. For example, if case option block 1 is chosen the index memory address of the memory

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bank 1 is stored in the high bank register 20 of memory 18 and the index memory address of the memory bank 2 is stored in the low bank register 22 of memory 18 and so on for the remaining case options 2-12. Now, once the at least 2 sets of

5   configurables had been selected through the front panel 28 and the index memory addresses corresponding thereto are stored in memory 18, the command option permitting the communication apparatus to switch communication dynamically between itself and a selected one of a

10   predetermined plurality of mating communication devices of different configurations may occur.

An exemplary flowchart for use by the control logic 12 to accomplish this dynamic communication switching operation is shown in Figs. 3A and 3B. Starting with Fig. 3A, the operation

15   is entered at decisional block 50 where the control logic 12 determines whether or not there has been a change in the state of the command signal 30. If there has been no change, the programming logic of Fig. 3A is circumvented and execution continues into the program logic of Fig 3B. If a change in the

20   state of the command signal 30 is detected by the block 50 then execution continues at decisional block 52 wherein it is determined whether the transition was from low to high or from high to low. If from low to high, the control logic 12 is instructed to access the index memory address of the high bank

25   register 20 of memory 18 for further use using the operational block 54. Otherwise, block 56 instructs control logic 12 to access the index memory address of the low bank register 22. In the next operational block 58, the memory bank corresponding to the accessed index memory address is enabled

30   utilizing the control lines OE associated therewith and the corresponding address lines of the enabled memory bank are set to the first byte register thereof.

Next, operational blocks 60 and 62 carry out the operation of loading the set of configurables of the enabled

35   memory bank into the active configuration memory,

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more specifically, the content of the addressed byte register
is provided from the enabled memory bank to the active
configuration memory 16 over the data lines 17 in accordance
with the instructions of operational block 60.   Concurrently
5   therewith, the OR gate 14 detects the generated enable signal
OE and directs a write enable (WE) signal to the memory 16 to
permit the data on the data line 17 to be written into the
appropriate address register of the memory 16.   Operational
block 60 then increments the address pointer to the next byte
10   register of both of the enabled option bank memory and active
configuration memory and moves on to the decisional block 62.
In 62, it is determined whether the complete set of
configurables of the enabled memory bank has been loaded into
the active configuration memory 16.   If not, the operational
15   blocks 60 and 62 are reexecuted until the entire loading
procedure has been complete.   Thereafter, execution continues
at decisional block 64 in the flowchart of Fig. 3B.

Referring to Fig. 3B, the decisional block 64 determines
if a change in the set of configurables of the configuration
20   memory 16 has taken place.   If not, the remaining program
steps of Fig. 3B are circumvented and the program execution
returns to the executive.   Otherwise, it is next determined in
the decisional block 66 if the change in configuration is to
leased line or dial line operation.   If the current configuration
25   is for leased line operation, block 68 is executed next and
modem is initialized for conventional modem operation in a
leased line environment.   Otherwise, the modem is initialized
for dial line operation in block 70 and an auto-call unit, such
as v.25bis, for example, is requested in block 72.   The program
30   then waits for a dial request in block 74, and when the request
is received, program execution continues.   Program execution
continues from either block 68 or 74 in block 76 wherein a
data connection is established in the mating communication
device corresponding to the communication configuration

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established by the set of configurables of the active configuration memory 16.

   A typical set of configurables which has been referenced to hereabove is shown in the Table 1 below along with typical
5   options therefor.

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TABLE 1

Session Specific Straps	Default (Option Set)	Option Description (Saved In EEPROM when "save changes" executed)	Front Panel Node	At ACU	NTWK	At No Access
Modulation Mode cm_mod_ mode	1 2 3 4	0 = V.32bis Auto 1 = Auto V.32 2 = V.32bis only 3 = V.32 only 4 = V.22 bis only 5 = 212 only 6 = v.21 only 7 = 103 only	Mod Mode = NAT MODMODE			
Auto Type cm_ autotype	1 2 3 4	0 = OOITT 1 = Codex	Auto Type = NAT_ATYPE			
Modulation Max/Min Data Rates (option selections depend on modulation mode) cm_min_ rate cm_max_ rate	min max	0 = 300 bps 1 = 1200 bps 2 = 2400 bps 3 = 4800 bps 4 = 7200 bps 5 = 9600 bps 6 = 12 kbps 7 = 14.4 kbps	Min/Max Rate = NAT_ MAXRATE NAT_ MINRATE			
Low Speed Format	Country Specific	0 = Bail 1 = OOITT	Low Speed NAT_ LOWSPEED			
Adaptive Rate Selection cm_ adaptive	1 2 3 4	0 = Off 1 = On	Adaptv = NAT_ ADAPTIVE			
Modem Mode select cm_mode_ select	1 3 2 4	0 = Originate 1 = Answer 2 = External 3 = Auto answer In Originate	Mode = NAT_ANSORG	AT CA		
synonron-ous Clock Select cm_timing_ select	1 2 3 4	0 = internal transmitter timing 1 = External transmitter timing 2 = Loopback transmitter timing	Clock = NAT_CLOCK	AT&X		

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Automatic retrain control cm_auto_ retrain	1 2 3 4	0 = Auto retrain disabled 1 = Auto retrain enabled on low EER 2 = Auto retrain enabled on high EER	Retrain = NAT_ RETRAIN	AT RT		
Longspace Disconnect cm_ longspace	1 2 3 4	0 = Disable 1 = Enable	Longspace = NAT_ LONGSPACE	ATY		
PSTN Cleardown cm_pstn	1 2 3 4	0 = Disable 1 = Enable	PSTN = NAT_PSTN	AT MD		

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DTE rate cm_dte_ rate	2 3 4 1	0 = 75 bits.sec 1 = 150 2 = 300 3 = 600 4 = 1200 5 = 2400 6 = 4800 7 = 7200 8 = 9800 9 = 12 kbits/sec 10 = 14.4 11 = 16.8 12 = 19.2 13 = 21.6 14 = 24 15 = 38.4 16 = autobaud	DTE Rate = NAT_ DTERATE			
Speed Conversion cm_speed_c onvert	1 2 3 4	0 = Disable 1 = Enable	Speed Conver = NAT_SPDCON	AT SC		
Character length cm_char_ length	1 2 3 4	0 = 8 bit character length 1 = 9 bit character length 2 = 10 bit character length 3 = 11 bit character length	Char Length = NAT_ CHARLEN			
DTR Control cm_dtr_ control	1 4	0 = DTR high, ignored by DCE 1 = Escape 2 = Disconnect on DTR high to low 3 = reset 4 = Tall (108/1 plus autoanswering with DTR off) 5 = 108/1 6 = 108.2	DTR = NAT_DTR			
DTR delay for switching cables cm_dtr_ delay	1 2 3 4	0 = time set by ATS25 1 = 10 seconds 2 = 15 seconds	DTR Delay = NAT_DTRDLY			

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RTS Control cm_rts_ control	1 2 3 4	0 = RTS normal 1 = RTS high 2 = Remote	RTS = NAT_RTS	AT & R		
CTS control cm_cts_ control (CTS control for all other modes)	2 3 4 1	0 = CTS high 1 = CTS normal 2 = CTS on during ACU 3 = Async/Sync	CTS = NAT=CTS	AT CT		

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RTS/CTS delay cm_rts_cts dly	2 3 4 1	0 = No Delay 1 = 15 millisecond delay 2 = 60 millisecond delay 3 = 90 millisecond delay 4 = delay set by ATS26	RTS/CTS Delay = NAT_DCO	AT DL		
DCD Control cm_dcd control	1 2 3 4	0 = DCD high 1 = DCD normal 2 = DCD on for ACU 3 = DCD remote	DCD = NAT_DCD	AT&C		
DSR Control cm_dsr_ control	3 4 1 2	0 = DSR normal 1 = DSR high 2 = DSR follows DTR 3 = drop on disconnet 4 = simulate leased line	DSR = NAT_DSR	AT & S AT MR		
Overspeed cm_ overspeed	1 2 3 4	0 = 1% 1 = 2.5%	Overspeed = NAT_ OVERSPD			
Answer Control cm_auto_ answer	Country Specific	0 = Manual answer, auto answer disabled 1 = Auto answer after 1 ring 2 = Auto answer after 2 rings 3 = Auto answer after 4 rings 4 = Auto answer after 8 rings 5 = Auto answer after ringcount set by ATSO	Answer = NAT_ANSWER	AT AA		
Default dial address number cm_default dial	2 4 1 3 use #1	0 = default dial disabled 1-9 = dial from phone number n	Default Dial = NAT DEFDIAL	AT DA		
Line Select cm_line_ select	1 2 3 4	0 = dial line 1 = 2 wire lease line	Line = NAT_ LINETYPE	AT & L		

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Restoral enable cm_restoral	1 2 3 4	0 = restoral disable 1 = restoral by front panel only 2 = restoral by 108/1 3 = restoral by circuit 115 4 = auto restoral	Restore = NAT_RESTORE			
Lease to dial Restoral Select cm_restore select	1 2 3 4	0 = low/fast 1 = low/slow 2 = high/fast 3 = high/slow	L to D = NAT_LTCD			

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Dial to lease retry time cm_dtol_time	1 2 3 4	0 = manual 1 = 15 minutes 2 = 30 minutes 3 = 1 hour 4 = 2 hours 5 = 4 hours	D to L NAT_DTCL			
Hold Dial Line cm_hold_dial	1 2 3 4	0 = off 1 = on	Hold Dial = NAT_HOLDLINE			
EC Data Transfer Mode select cm_ac_mode	2 3 1 4	0 = Direct Mode 1 = Normal mode 2 = Reliable mode 3 = Auto reliable mode 4 = speed dependant auto reliable	Mode = NAT_ECMODE	AT SM		
Error Correction cm_ec_select	1 2 3 4	0 = V.42 1 = LAPM only 2 = MNP only	EC = NAT_ECSLOT	AT EC		
Data comp-ression cm_data_comp	1 2 3 4	0 = Off 1 = On	DC = NAT_DOENABLE	AT DC		
Flow control selection cm_flow_cntl (local-terminal)	1 2 3 4	0 = off, no flow control 1 = XON/XOFF with no pass through 2 = DTR/CTS 3 = RTS/CTS 4 = XON/XOFF with pass through	Flow = NAT_FLOWCTL	AT FL		
Error Correction break select cm_ec_break	1 2 3 4	0 = Destructive and expedited 1 = Non-destructive and expedited 2 = Non-destructive and non-expedited	Break = NAT_EOBREAK	AT BK		
Modem Flow cm_modem_flow	1 2 3 4	0 = Off 1 = On	Modem Flow = NAT_MODFLOW	AT MF		

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EC connect message control cm_ec_con_ msg	1 2 3 4	0 = off (Hayes connect messages) 1 = Short (reliable connect messages) 2 = Long (expanded reliable connect messages)	Reliable Msg = NAT_RELMSG	AT XD		
EC Identifica -tion cm_ec-id	1 2 3 4	0 = default 1 = Codex	EOID = NAT_EOID	AT S		
ACU Selection cm_acu_ select	1 3 24	0 = AT 1 = V.25 2 = No ACU	ACU Select = NAT_ ACUSLOT			
AT Format cm_at_ format	1 2 3 4	0 = Async 1 = Sync/data 2 = Sync 2 3 = Sync 3	AT Form = NAT_ATFORM	AT&M		

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V.25 bis Format cm_v25_ format	1 2 3 4	0 = Async 1 = Async/Sync 2 = Bitsync 3 = Charsync	V25 Form = NAT_ V25FORM	AT & M		
No ACU Selected Format cm_noacu_ format	1 4 2 3	0 = Async 1 = Sync	NoACU Form = NAT_NCACU	AT & M		
V.25bis character set cm_v25_ char_set	1 2 3 4	0 = ASCII character set 1 = EBOIDIO character set	Char Set = NAT_ CHARSET			
V.25bis sync Idle character cm_idle_ mode	1 2 3 4	0 = mark 1 = character	ACU Idle = NAT_ AOUIDLE			
V.25bis response cm_v25_ call_resp	1 2 3 4	0 = call response disabled 1 = bis 2 = bisrate 3 = val	Resp = NAT_ RESPONSE			
Parity cm_v25_ parity	1 2 3 4	0 = V.25 bis 1 = even parity 2 = odd parity 3 = mark parity 4 = space parity	Parity = NAT_PARITY			
Echo async chars to DTE cm_v25_par ity	1 2 3 4	0 = echo disabled 1 = echo enabled	Async Echo = NAT_ECHO	ATE		
Time to send Connect Message cm_conmsg_ time	1 2 3 4	0 = Off, message sent after DCO 1 = On, message sent before DCD for AT	Msg Early = NAT_ MSGEARLY			
Result code display = Quiet mode cm_result_ code	1 2 3 4	0 = enable ATCO result code 1 = disable AT01 result code	RsltCode = Nat_ RSLTCODE	ATC		

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Message format control cm_result_ form	1 2 3 4	0 = ATV0 short form - numerical codes 1 = ATV1 long form - full word result codes	RsltForm = NAT_ RSLTFORM	ATV		

      The illustration of Fig. 4 exemplifies dynamically switched communication on demand between a communication device and a selected one of either of two other mating devices. More specifically, a data terminal 80 communicates

5   through communication apparatus 82 referred to as Modem B. The combined communication set 80/82 is shown coupled to another data terminal 84 through a first mating

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communication device 86 referred to as Modem C. In this
example, a two wire leased line 88 is used as a communication
medium therebetween. Another data terminal 90 is coupled to
a second mating communication device 92 referred to as

5   Modem A. The combined equipment 80/82 may be coupled to
the combined communication equipment 90/92 over a
conventional dial network 94 using conventional dial lines 96.
The Modems A, B and C may be of the type manufactured by
Codex bearing Model No. 2266 of the V. 32 variety. A command

10   signal may be provided by the data terminal 80 to the
communication apparatus 82 over a circuit 116 which may be a
part of the communication protocol between the units 80 and
82.

      In the illustration of Fig. 4, the data terminal 80 desires

15   to communicate with the data terminal 84 through respective
Modems 82 and 86 over the two wire lease line 88 under
normal operations. Thus, the command signal 116 is set low
and the set of configurables associated with option data bank 4
is loaded into the active configurable memory to allow the

20   Modem 82 to configure itself compatible with the Modem 86.
Should the communication over the leased line 88 be
discontinued for any reason, the data terminal 80 detects this
condition and switches the state of the command signal 116 to
a high state. The Modem 82 responds dynamically to the change

25   of state of the command signal 116 in accordance with the
flowcharts of Figs. 3A and 3B to alter its communication
configuration to that of the set of configurables in the option
data bank 1 so that it is compatible with the Modem 92 in
order to communicate with the data terminal 90 in a dial

30   environment. Thus, Modem 82 is dynamically operative to
switch communication between itself and either the first
mating communication device or the second mating
communication device in response to the command signal 116
as exemplified in the illustration of Fig. 4.

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While the present invention has been described in
connection with a particular embodiment, it is understood

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that modifications and additions may be made to this embodiment or even an equivalent embodiment used without deviating from the broad principals of the present invention. Accordingly, the present invention should not be limited to any single embodiment but rather construed in both scope and breadth in accordance with the recitation of the appended claims.

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We claim:

1.   Communication apparatus operative to switch
communication dynamically between itself and any one of a
5   plurality of mating communication devices of differing
configurations, said communication apparatus comprising:
        means for storing a plurality of different sets of
configurables, each set of configurables of said plurality
corresponding to a communication configuration associated
10   with a corresponding mating communication device of said
plurality; and
        control means coupled to said storing means and
responsive to a command to switch communication of said
apparatus from a first mating communication device to a
15   second mating communication device of said plurality to
dynamically control said apparatus to switch from using the
set of configurables of said memory means associated with
the first mating communication device to using the set of
configurables of said memory means associated with the
20   second mating communication device for establishing the
communication configuration thereof.

2.   The communication apparatus in accordance with claim 1
wherein the storing means includes a plurality of memory
25   storage banks for storing correspondingly each of the
plurality of different sets of configurables; and wherein
the control means includes means responsive to said command
to dynamically control the apparatus to switch from using
the set of configurables of the memory bank associated with
30   the first mating communication device to using the set of
configurables of the memory bank associated with the second
mating communication device for establishing the
communication configuration thereof.

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3.   The communication apparatus in accordance with claim 2
including an active configuration memory loadable with a
set of configurables from said storing means, said
configurables loaded into the active configuration memory
5   being used by said apparatus to functionally configure
itself for communicating with a chosen mating communication
device.

4.   The communication apparatus in accordance with claim 3
10   wherein at least one of:
        the control means includes means responsive to said
command to dynamically load the set of configurables of the
memory bank associated with the second mating
communication device into the active configuration memory
15   for use by the apparatus in functionally configuring itself to
communicate with the second mating communication device in
accordance with said command, and
        the plurality of memory storage banks are of the non-
volatile type and the active configuration memory is of the
20   volatile type.

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5.   Communication apparatus operative to switch communication dynamically between itself and a selected one of a predetermined plurality of mating communication devices of differing configurations, said communication
5   apparatus comprising:
       means for storing a plurality of different sets of configurables, each set of configurables of said plurality corresponding to a communication configuration associated with a corresponding mating communication device of said
10   predetermined plurality, each set of configurables being indexed in said storing means by a unique memory address; and
       control means responsive to a command signal to select an index memory address for use by said apparatus to
15   functionally configure itself in accordance with the set of configurables of said storing means corresponding to the index memory address selected by the command signal.

6.   The communications apparatus in accordance with claim
20   5 including at least one of:
       second means for storing the index memory addresses of at least two sets of configurables of said plurality; and wherein the control means includes means responsive to the command signal to select an index memory
25   address from the second storing means for use by the apparatus to access and use the set of configurables corresponding thereto, and
       an entry device coupled to the control means for entering the index memory addresses of the at least two
30   sets of configurables into the second storing means.

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7.   Communication apparatus operative to switch
communication dynamically between itself and any one of at
least two mating communication devices selected from a
predetermined multiplicity of mating communication devices
5   of differing configurations, said communication apparatus
comprising:
        first means for storing a multiplicity of different sets
of configurables, each set of configurables of said
multiplicity corresponding to a communication configuration
10   associated with a corresponding mating communication device
of said predetermined multiplicity, each set of
configurables being indexed in said storing means by a
unique memory address;
        second means for storing the index memory addresses of
15   the sets of configurables corresponding to the selected at
least two mating communication devices;
        third storing means loadable with a set of
configurables from said first means for use by said
apparatus to functionally configure itself for
20   communicating with the mating communication device
associated therewith; and
        control means responsive to a command signal to select
an index memory address from said second storing means and
to load the third storing means with the set of
25   configurables from the first storing means corresponding to
said selected index memory address, whereby the apparatus
will functionally configure itself in accordance with the
set of configurables selected by the command signal.

30   8.   The communication apparatus in accordance with claim 7
including an entry device coupled to the control means for
entering the index memory addresses of the selected at
least two mating communication devices into the second
storing means.

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9.   The communication apparatus in accordance with claim 7
wherein the first storing means includes a multiplicity of
memory storage banks for storing correspondingly each of
5   the multiplicity of different sets of configurables, each
memory storage bank being indexed by the index memory
address of its corresponding set of configurables; and
wherein the control means includes means responsive to the
command signal to select an index memory address from the
10   second storing means and to load the third storing means
with the set of configurables accessed from the memory
storage bank corresponding to the selected index memory
address.

15   10.   The communication apparatus in accordance with claim 7
wherein the first storing means is of the non-volatile type
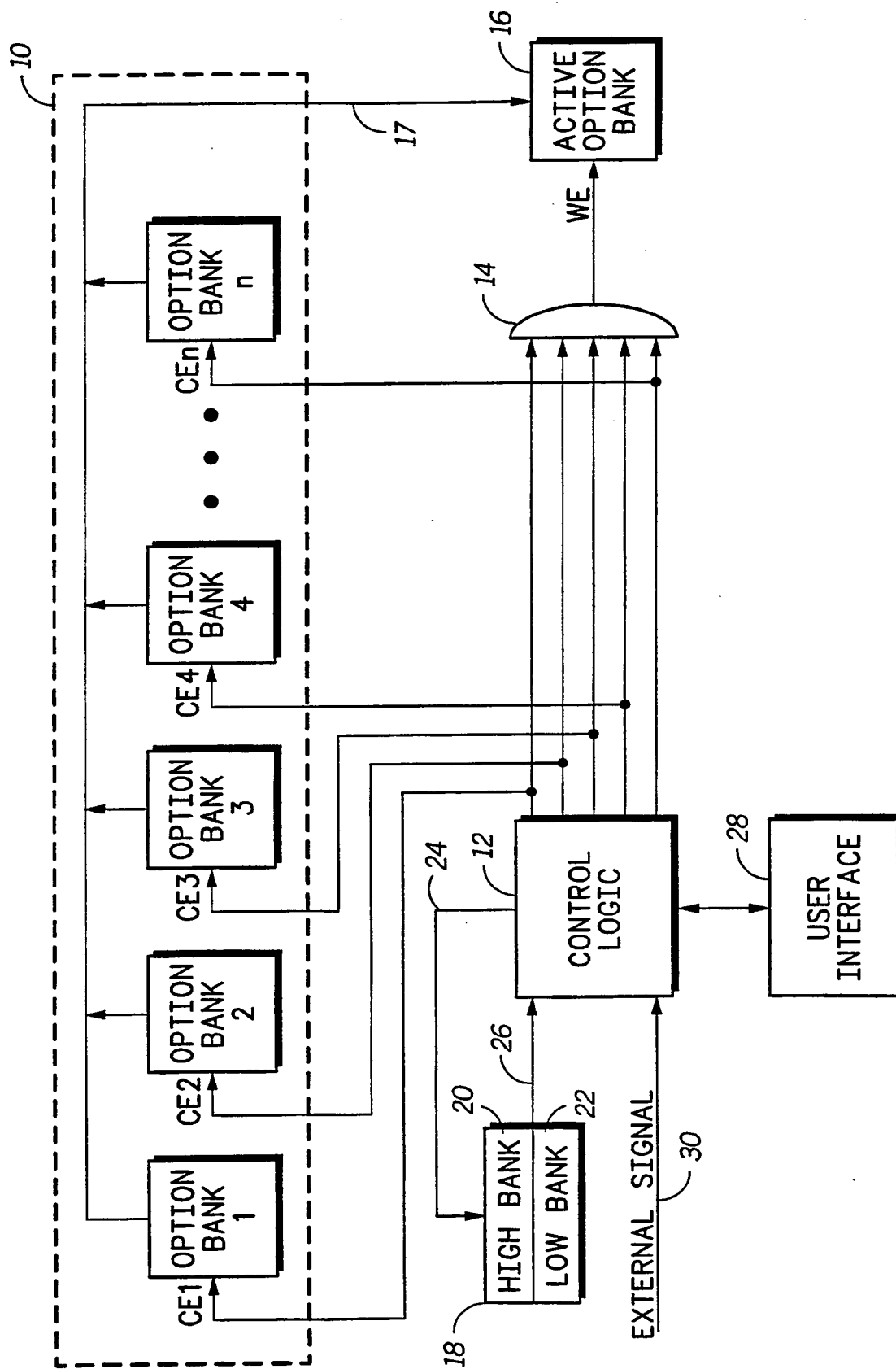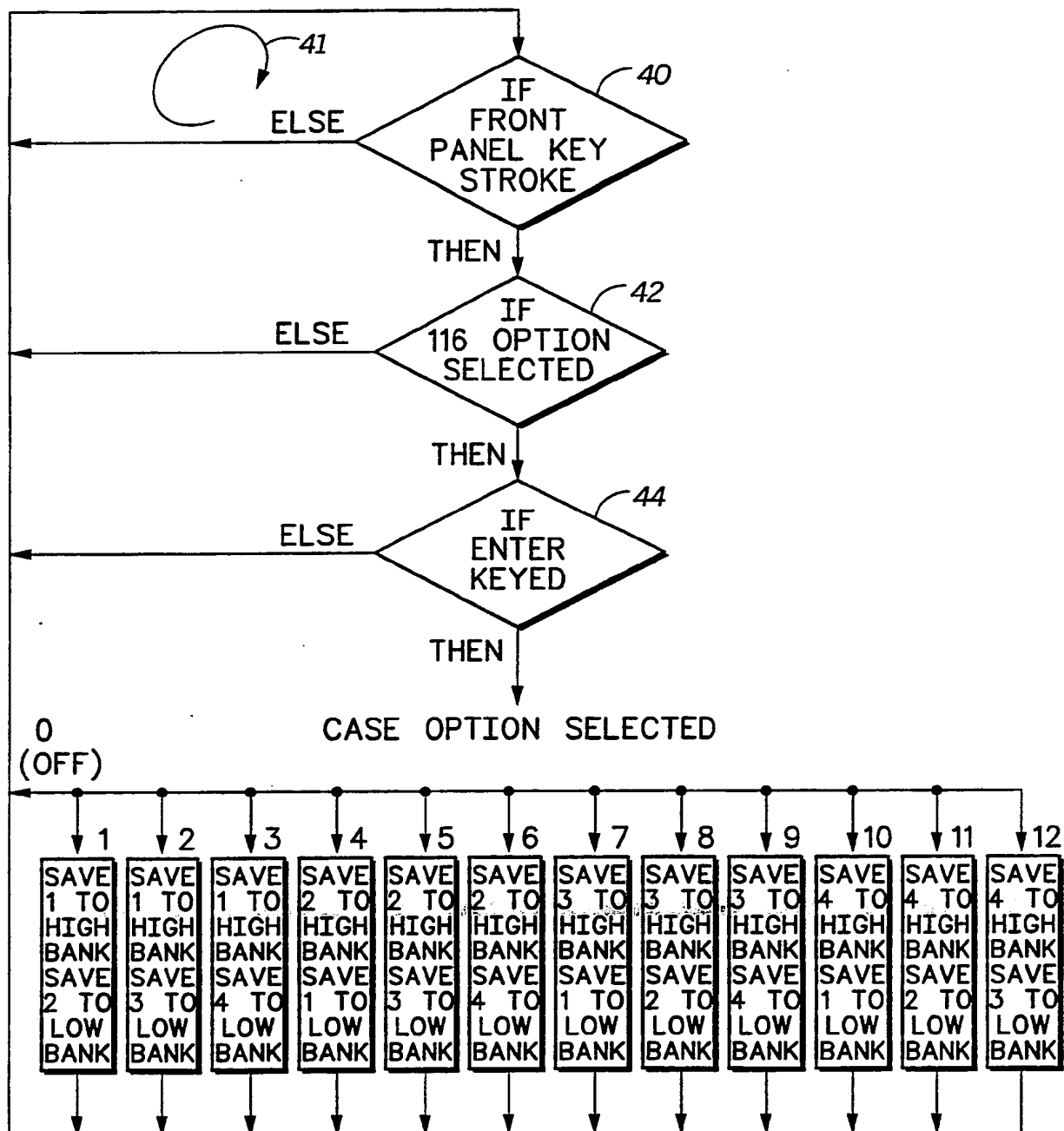and the third storing means is of the volatile type.
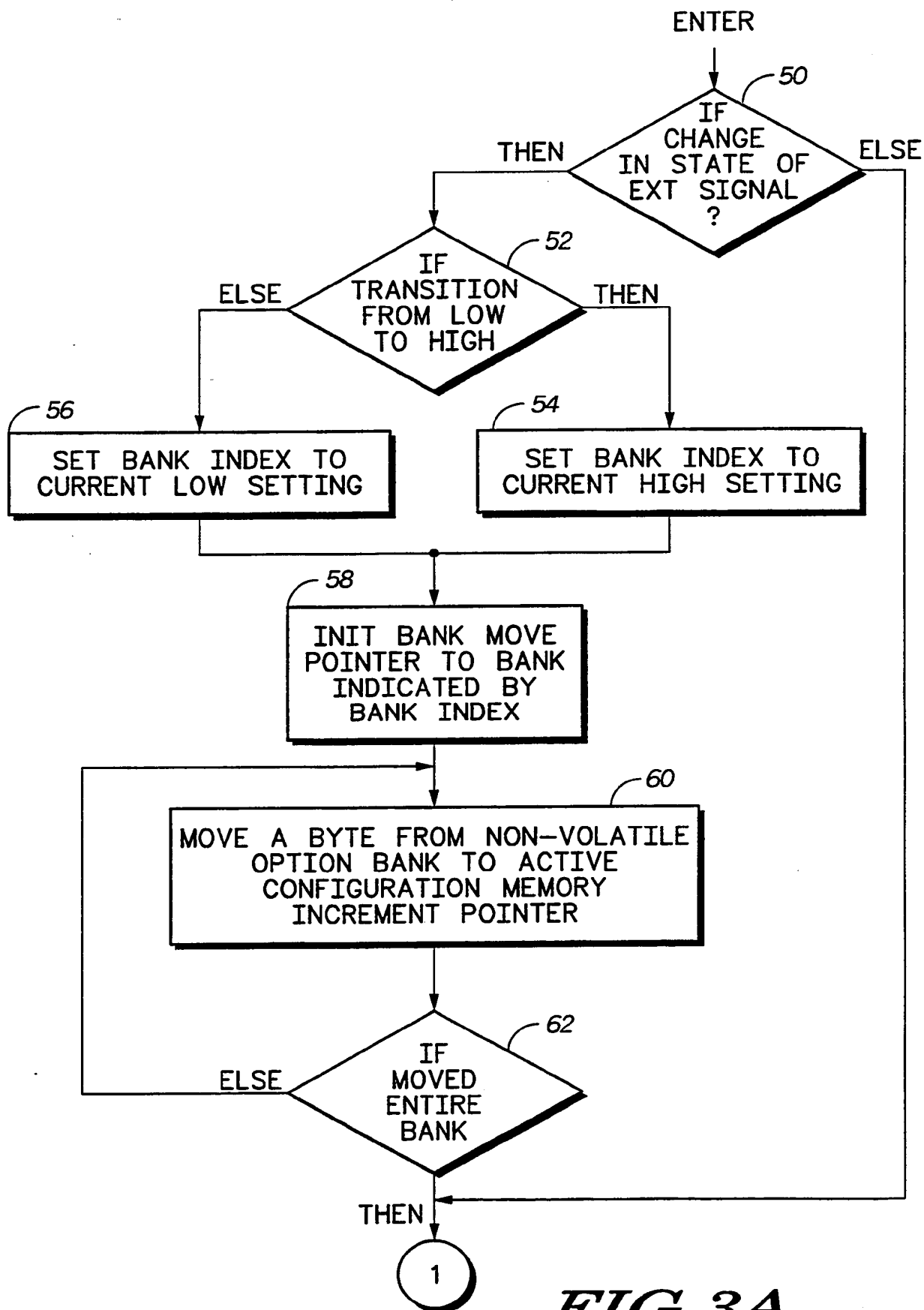
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FIG.1

FIG.2

ENTER

50
IF
CHANGE
IN STATE OF
EXT SIGNAL
?

THEN   ELSE

52
IF
TRANSITION
FROM LOW
TO HIGH

ELSE   THEN

56
SET BANK INDEX TO
CURRENT LOW SETTING

54
SET BANK INDEX TO
CURRENT HIGH SETTING

58
INIT BANK MOVE
POINTER TO BANK
INDICATED BY
BANK INDEX

60
MOVE A BYTE FROM NON—VOLATILE
OPTION BANK TO ACTIVE
CONFIGURATION MEMORY
INCREMENT POINTER
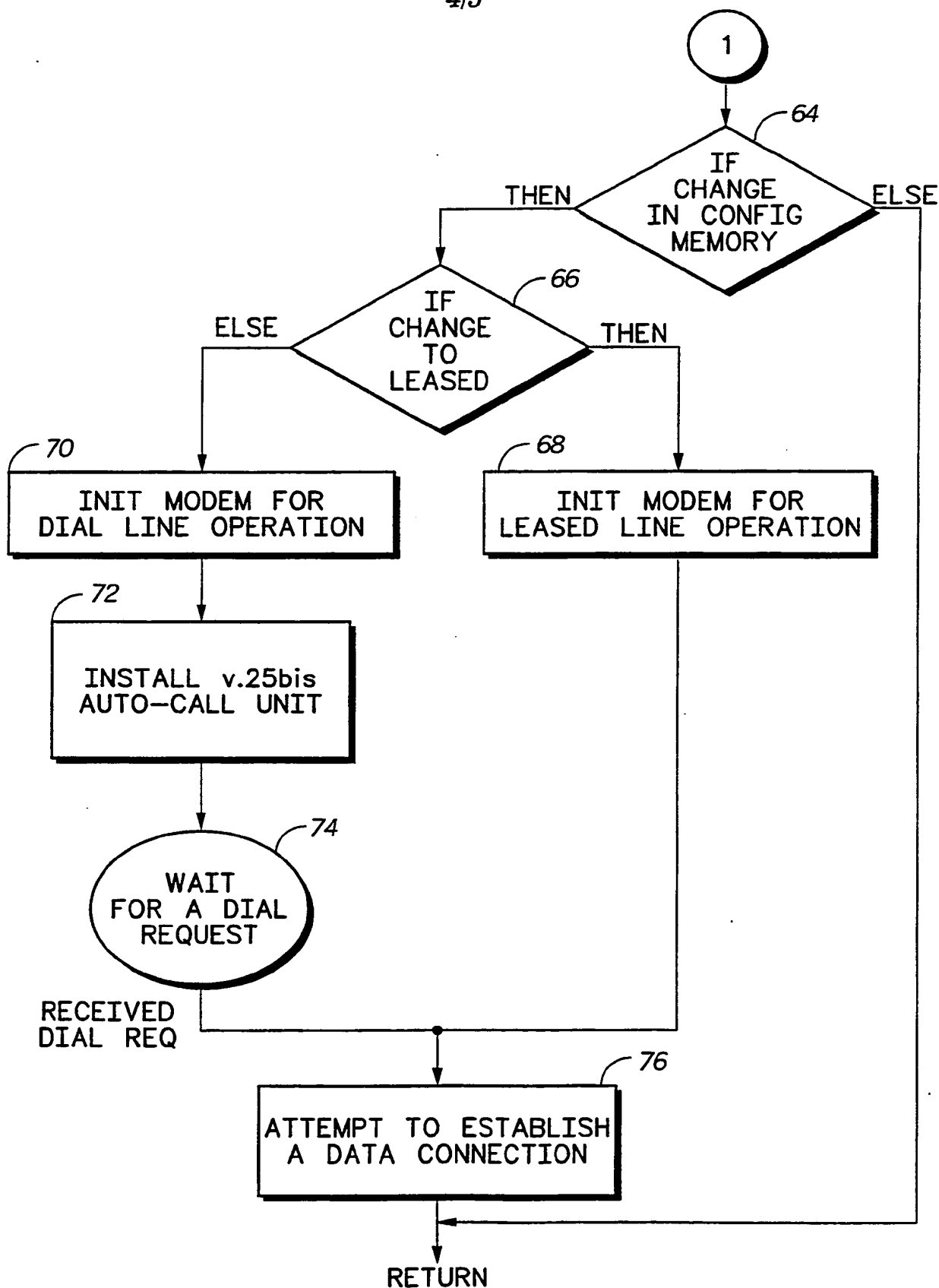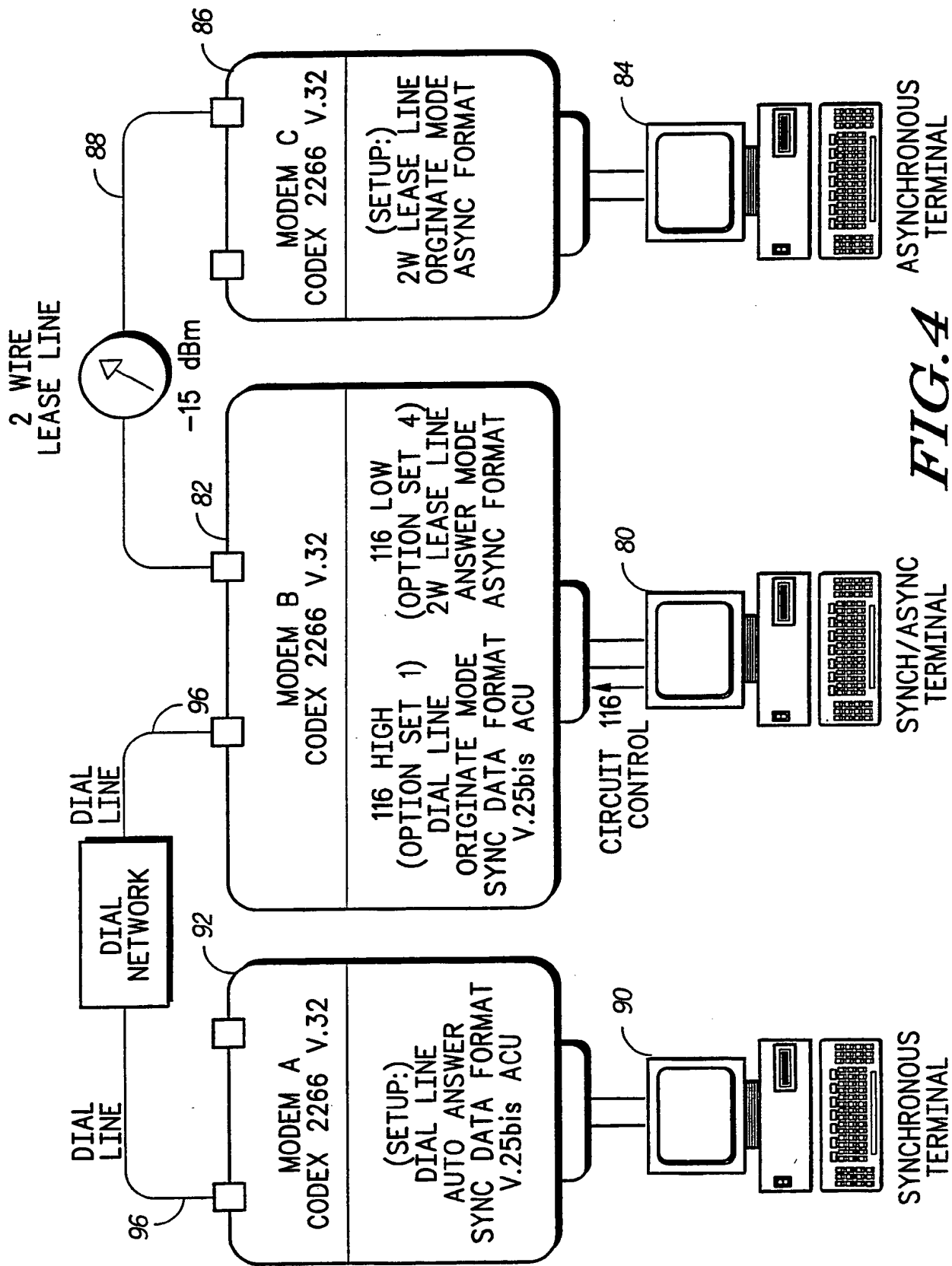
62
IF
MOVED
ENTIRE
BANK

ELSE

THEN

1

FIG.3A

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FIG.3B

FIG.4

INTERNATIONAL SEARCH REPORT

International Application No. **PCT/US91/09484**

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC(5): G06F 3/023, 3/03, 3/05, 3/14, 9/06, 9/455, 13/10, 13/42, 15/56, 3/02
US CL : 395/200, 395/325, 395/700, 395/500, 370/32

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
U.S.	395/200, 395/325, 395/700, 395/500

Documentation Searched other than Minimum Documentation
to the Extent that such Documents are Included in the Fields Searched [8]

APS DATABASE

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category [*]	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
Y	US, A, 4,688,170 (WAITE) 18 AUGUST 1987 See figs. 1-2, col. 1, line 64 - col. 5, line 47.	1-10
Y	US, A, 4,924,456 (MAXWELL) 08 MAY 1990 See figs. 1-13, col. 2, line 15 0 col. 11, line 22, col. 12, lines 13-68, col. 13, line 1 - col. 18, line 32, col. 18, line 41 - col. 20, line 68.	1-6
Y	US, A, 4,787,063 (MUGUET) 22 NOVEMBER 1988 See figs. 1-2, fig. 4, col. 2, line 55 - col. 6, line line 54, col. 9, line 30 - col. 11, line 65.	1-7
Y	US, A, 4,453,211 (ASKINNZI) 05 JUNE 1984 See figs. 1-6c, col. 1, line 1- col. 14, line 26, col. 21, line 1 - col. 22, line 68.	1-4

* Special categories of cited documents: [10]

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
06 FEBRUARY 1992	10 APR 1992

International Searching Authority	Signature of Authorized Officer
ISA/US	NGUYEN NGOC-HO INTERNATIONAL DIVISION For DANIEL H. PAN

Form PCT/ISA/210 (second sheet) (Rev. 11-87)